

ASCI University Partnerships Program

History and Background

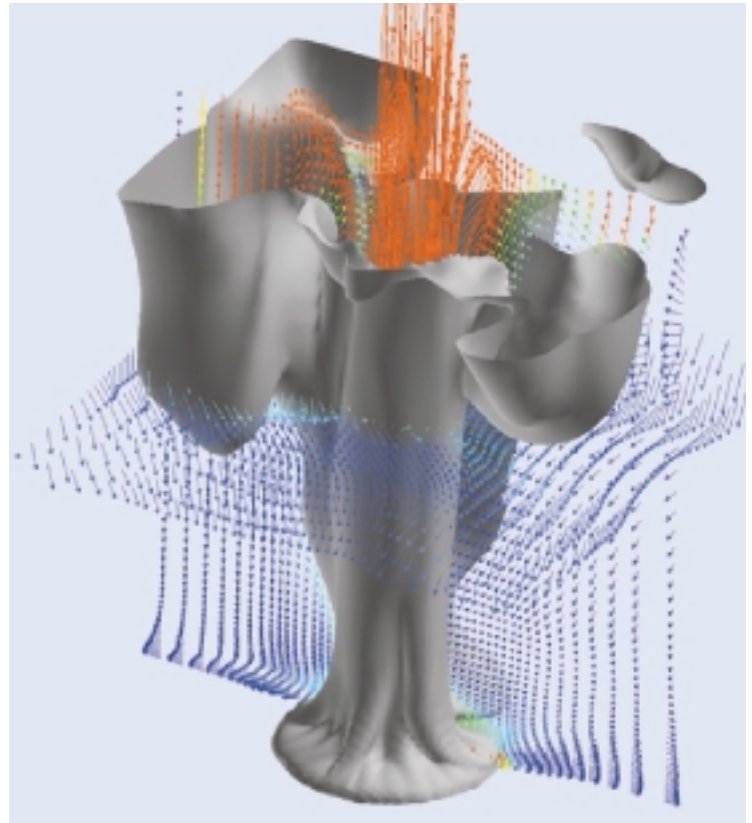
The Advanced Simulation and Computing program (which retains its historical acronym ASCI) creates simulation capabilities through the development of advanced weapons codes and high-performance computing that incorporate high-fidelity scientific models validated against experimental results, past tests, and theory. The goal is to meet the science-based simulation requirements of the Stockpile Stewardship Program (SSP) so that the National Nuclear Security Administration (NNSA) can complete its nuclear weapons responsibilities. This includes the means to assess and certify the safety, performance, and reliability of nuclear weapons.

The ASCI program actively addresses stockpile issues by developing and using simulations to study problems ranging from advanced design and manufacturing processes, to understanding accident scenarios, to weapons aging and to the resolution of Significant Finding Investigations (SFI). This spectrum of scientific inquiry demands a balanced system of hardware, software, and computer science solutions.

Academic Strategic Alliances Program (ASAP)

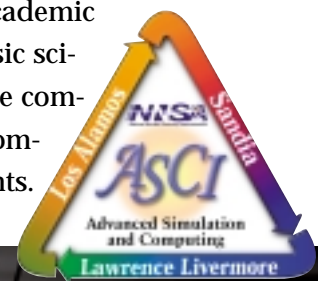
Collectively, the institutions in ASAP are known as the Alliances. Major goals for the program can be summarized as follows.

- Solving science and engineering problems of national importance through large-scale, multidisciplinary modeling and simulation.



Through computational simulation, the buoyant plume from a raging pool fire is seen to punch into the atmosphere. Extracted from the massive set of data computed, this illustration shows the plume frozen at a moment in time. The gray surface indicates a constant carbon dioxide concentration and the arrows depict velocity vectors (with temperature in color) at two cross-cutting planes. The simulation of a fire of a pool of liquid is based on a steady state, 3-D, buoyancy-driven, natural convection model.

- Establishing and validating large-scale modeling and simulation as viable scientific approaches essential to numerous scientific applications requiring integration across disciplines and complex simulation sequences.
- Enhancing the overall ASCI effort by engaging academic experts in computer science, computational mathematics, and simulations of science and engineering.
- Leveraging relevant academic research, including basic science, high-performance computing systems, and computational environments.



- Strengthening education and research in areas critical to the long-term success of ASCI and the SSP.
- Strengthening ties among the NNSA national laboratories and participating U.S. universities.
- Fostering computational science as an academic discipline.

Historically, some academic institutions have maintained a close relationship with the three NNSA national laboratories. For example, the University of California has managed both Los Alamos and Lawrence Livermore for many years. The ASCI program created new and critical interests in simulation science and high-performance computing that linked laboratories and universities.

Strategic Alliances

Five academic centers are engaged in long-term, large-scale, unclassified, integrated multidisciplinary simulation and supporting science and computational mathematics of interest in ASCI-class problems.

- California Institute of Technology Center for Simulating Dynamic Response of Materials.
- Stanford University Center for Integrated Turbulence Simulation.
- University of Chicago Center for Astrophysical Thermonuclear Flashes.
- University of Illinois, Urbana-Champaign Center for Simulation of Advanced Rockets.
- University of Utah Center for Simulation of Accident and Fire Environments.

The centers completed their first five-year funding commitment in September 2002, and funding has been renewed for an additional five years. Currently, these centers collectively have access to approximately 10% of the ASCI-class computing resources at the three NNSA national laboratories, and 10% of the computing resources of the National Science Foundation's National Partnership for University of California San Diego Advanced Computational Infrastructure Center.

ASCI Institutes

In addition to the Alliances, academic collaborations include the ASCI Institutes, initiated in FY2000. The Institutes are located at each of the three NNSA national laboratories, and their charter is to create an environment for collaboration with academia on research topics in computer science, computational mathematics, and scientific computing relevant to the SSP. These collaborations range from one-day seminars to sabbaticals taken at the laboratories. The collaborations at each of the Institutes differ somewhat, depending on laboratory needs. They all, however, coordinate and leverage their activities to ensure the maximum benefit to ASCI.

Alliances/Institutes Strategies

- Encouraging strategic alliances and collaboration.
- Leveraging other national initiatives.
- Collaborating with the best R&D programs of other departmental offices, other agencies, universities, and industry.
- Attracting top researchers in key disciplines for weapon applications.
- Forming long-term strategic alliances with a small number of universities and academic consortia to fund critical long-term ASCI work, such as high-confidence simulations.
- Establishing smaller-scale collaborations with individual investigators and research groups to work on narrowly focused problems, such as fluid turbulence.
- Exposing students and postdocs to career opportunities at the NNSA national laboratories.

Information compiled from the Advanced Simulation and Computing (ASCI) Program Plan 2002-2003 (SAND-2002-2940P), issued by Sandia National Laboratories, a Department of Energy Laboratory operated by Sandia Corporation, a Lockheed Martin Company, under contract DE-AC04-94AL85000. The Program Plan was issued under the joint auspices of Sandia National Laboratories, Los Alamos National Laboratory, and Lawrence Livermore National Laboratory.